THURSDAY, MARCH 19, 1891.

WOOD'S HOLL BIOLOGICAL LECTURES.

Biological Lectures delivered at the Marine Biological Laboratory of Wood's Holl, in the Summer Session of 1890. Pp. v. + 250. Illustrated. (Boston, 1891.)

AS we are informed in the preface, the ten addresses and lectures contained in this little volume were, with two exceptions, delivered at the Marine Biological Laboratory of Wood's Holl, as a continuation of a previous course. The volume is issued under the editorship of Prof. C. O. Whitman, the Director of the Laboratory, but each article appears to have been seen through the press by its respective author, as we notice some differences in the degree to which phonetic spelling has been adopted.

It is stated that one object of these lectures—which deal with some of the higher problems of biology, and among them those with a more or less pronounced metaphysical leaning—was to bring specialists into mutual communication and helpful relations with one another, and, at the same time, to make their work and thought intelligible and useful to beginners. It strikes us, however, that some of these lectures are altogether over the heads of most beginners; this being, indeed, practically acknowledged in a later paragraph of the preface. And, considering the generally practical tendency of the American mind, it also strikes us as somewhat remarkable that in scientific circles there should be such a marked tendency towards speculations which, to put it mildly, contain such a large amount of theory based on such an extremely small modicum of fact.

The lectures cover a very wide expanse of ground—from the Gastræa theory to Weismann on the origin of death, and from the relationship of the sea-spiders to ocean temperatures and currents. All of them are, indeed, practically reviews of the current opinions on the topics with which they respectively deal; and to review them critically would therefore be practically reviewing a review. Moreover, since each lecture or article is the work of a specialist on a more or less highly abstruse subject, it would require a committee of specialists on the subjects dealt with to venture on such a critical review. We shall, therefore, content ourselves with giving the titles of the various lectures, and calling attention to those points which appear to us to be of more than average interest. We heartily commend the volume as a first-rate *résumé* of the current opinions regarding several interesting biological problems, and we shall look forward to seeing it followed next year by a second volume containing the lectures which, we presume, are to be delivered during the coming summer.

The first lecture, on "Specialization and Organization," is by the editor; who first shows how specialization is met with in nature, and then mentions how necessary it is for the right study of nature. While, however, admitting the necessity of specialization in natural studies, the author urges the importance of organization and cooperation. Co-operation, indeed, is considered to be fairly well up to the requirements of the times, owing to the number and efficiency of our scientific journals; but the need for organization is strongly urged, and the author waxes eloquent on the advantages which would be derived from the establishment and endowment of a national biological station in the United States.

In the course of this lecture, Prof. Whitman refers to the recent Japanese experiments on *Hydra*. These tend to show that this creature is more specialized than was originally supposed to be the case; Trembley having omitted to notice that when turned inside out the Hydra again turns itself back to its normal condition, so that the functions of its inner and outer surfaces are not interchangeable, as was first supposed.

The second lecture is likewise by Prof. Whitman, and has for title "The Naturalist's Occupation." The chief object of the first part of this lecture appears to be to inculcate the importance of discovering what are really fundamental characters in animals, and of using these, and these only, in classification, which the lecturer urges should be based on genealogical lines. The Vertebrate affinities of the Ascidians are strongly insisted upon, the author even going so far as to say "that we are compelled to place them in the same great family;"—an opinion with which many zoologists will be by no means disposed to agree, even if they admit an affinity between the two groups. The second part of this lecture takes the special problem presented by the Vertebrate head—as to whether or no it is composed of a number of segments serially homologous with those of the body. After reviewing the original theory of the segmentation of the whole head, it is stated that embryology has now clearly shown that, although wide of the mark in its entirety, the theory rests on a fundamental basis of truth, there being conclusive evidence to show that at least the hinder part of the head is segmented, and the problem to decide being how far forwards this segmentation extends, or how many segments the head contains. The difficulty of determining which is head and which vertebral column in embryos and the Lancelet, is then referred to; this being followed by a discussion of the view that the fore-brain alone represents the original ancestral brain, while the mid- and hind-brain are formed from modified trunk-segments pressed into the service of the head. That this view is true, so far as concerns the mid- and hind-brain, is regarded as practically established; and the conflict is accordingly now restricted to the origin of the fore-brain. Here we are limited to three hypotheses: either the fore-brain is the inherited, unsegmented, ancestral brain of the Invertebrates; or it is an entirely new formation; or it represents a number of fused trunk-segments, among which the ancestral brain is unrecognizable. The third hypothesis is the one which appears to be steadily advancing in favour, but, as the author rightly observes, we are here mainly or entirely dealing with conjectures, and have at present no solid ground to work from. In regard to the genesis of the eyes of Vertebrates, it is stated that all the evidence points to their derivation from paired segmental sense-organs; and from this point of view the author seems inclined to support the doubt which Leydig has thrown on the pineal eye, since it is argued that the existence of such an organ would imply the coalescence of at least one pair of eyes, and we have no example of any analogous fusion in the Vertebrata.

The third lecture dealing with "Some Problems of

Annelid Morphology," is by Prof. E. B. Wilson. In this lecture the chief points dealt with relate to the larval Annelid form known as the *Trochophore*, and the subjects of metamerism and apical growth. The circumstance that the Trochophore corresponds only to the head of the adult Annelid, the trunk of the latter being formed as a bud growing from the lower end of the larva and then segmenting, and thus being a typical instance of apical growth, suggests that the trunk is a linear colony of sexual individuals budded off from the asexual head. And if this be so, then all metameric animals must be regarded as colonial organisms, comparable, so far as regards individuality, with a polyp-colony. Some zoologists have actually accepted this view, while others have propounded alternative hypotheses, none of which the author regards as satisfactory explanations of metamerism; and he concludes by stating that we are not at present in a position to offer any adequate intepretation of this difficult problem. With regard to the nature of the Trochophore, opinion is still undecided; but the author's own inclination is to regard it as a secondary production, and thus of no importance in genealogical questions: a similar view is expressed by Prof. T. H. Morgan in the seventh lecture.

We shall venture to pass over Prof. J. P. McMurrich's admirable summary of the Gastræa theory and its successors, in the fourth lecture, and pass on to the fifth and sixth of the series. These are on kindred subjects, the former being by Mr. E. G. Gardiner, and bearing the title of "Weismann and Maupas on the Origin of Death;" while the latter is by Prof. H. F. Osborn, of Princeton College, and is entitled "Evolution and Heredity." Prof. Osborn has given a more recent epitome of his views of the latter question in a paper read before the American Society of Naturalists at Boston, on December 31, 1890, entitled "Are Acquired Variations Inherited?"

Weismann's theory of the origin of death, our readers need scarcely be reminded, is based on his observations on the Protozoa, in which he finds that since one of these creatures reproduces itself by dividing into halves, each of which starts again as a young animal, there is normally no decay or death, but rather a potential immortality. In the Metazoa, on the other hand, each individual passes through a period of youth, adult life, and old age, finally ending its existence in death. And since the Metazoa have been derived from the Protozoa, it is argued that death is something acquired with the development of the one from the other. It is further urged that when death had once made its appearance it was received as a distinct advantage by the animal world, or nature. And we have further the well-known "continuity of the germ-plasm" theory, in which it is considered that the germ-cells of the Metazoa are those which have inherited the Protozoan immortality; the so-called somatic cells being, so to speak, an addendum to the germ-plasm which have lost their potential immortality; this loss being perhaps due to what is termed the neglect of natural selection, owing to the somatic cells (the body) being merely the protective case to the germ-plasm.

Mr. Gardiner states that since Prof. Weismann started this remarkable theory much opposing evidence has been brought against it; one of his strongest opponents being M. Maupas, of Algiers, who enters the lists by declaring that death and decay do occur normally among the Protozoa, and thus, if right, cutting away the very ground from Weismann's feet. This leads Mr. Gardiner to conclude that we are not at present entitled to regard the Protozoa as potentially immortal, nor to claim that the somatic cells of the Metazoa have no representatives in the Protozoa. It is added, "Nevertheless, it is too soon to declare that the idea that death is an adaptation is altogether erroneous"—a sentence that to our thinking tends to convey the idea that the lecturer considers that a theory based on false premises may yet probably be true.

Other objections to the theory are then considered; among which it will suffice to mention the one founded upon the various ages to which different animals attain; but the arguments employed appear somewhat difficult to follow, and not to advance the question much in one way or another.

Prof. Osborn's lecture is intimately connected with the preceding one, treating of the question whether the neo-Darwinism of Weismann or the neo-Lamarckism of Eimer best explains the phenomena of heredity, in which the chief *crux* is whether acquired characters are or are not transmissible. The neo-Lamarckians maintain that special and local variations in function and structure induced by environment and habit in the life of a parent tend to reappear in some degree in the offspring. On the other hand, Weismann and the neo-Darwinists contend that special individual variations are not transmitted from parent to offspring.[1] The lecturer states that a complete theory of heredity must account for the repetition phenomena (including reversions); for the non-repetition phenomena, or the appearance of new characters; and for the phenomena of physical transmission, which can be only worked out by the embryologist.

In regard to Weismann's views it should be observed that especial importance is attached to the "continuity of the germ-plasm," to which we have already alluded, and still more so to his doctrine of the isolation of the germ-cells from all influences which affect the body, or somatic cells; so that the former cannot be reached by slight acquired variations. Inheritance being the unbroken transmission of racial and ancestral characters by subdivision of the germ-plasm, only changes which affect the body as a whole can be added to the characteristics of the germ-plasm.

Prof. Osborn expresses his own opinion to the effect "that upon the side of evolution, or non-repetition in inheritance, the neo-Lamarckians have much the best of it; while upon the side of repetition and embryology, their opponents are strongest." But he significantly adds that in analyzing the arguments of some of the neo-Lamarckians he finds nearly as much against as in favour of the principle for which they contend. Finally, the necessity of moderation in the discussion is strongly urged, the present spirit displayed by the two sides not being conducive to the settlement of these apparently irreconcilable opinions. "I claim," the lecturer continues, "if the neo-Lamarckians can demonstrate by palæontological or other evidence that acquired characters are inherited, it rests with the embryologists to furnish a theory of physical transmission. On the other hand, the embryologists may show conclusively that such inheritance is impossible."

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[1] See Prof. Lankester's article in Nature of March 6, 1890, p. 415.

At the end of his address on acquired characters, Prof. Osborn observes that "it follows as an unprejudiced conclusion from our present evidence that upon Weismann's principle [the non-transmission of special individual variations] we can explain inheritance but not evolution, while with Lamarck's principle [the transmission of acquired variations], and Darwin's selection-principle, we can explain evolution, but not, at present, inheritance. Disprove Lamarck's principle, and we must assume there is some third factor in evolution of which we are now ignorant."

A totally different subject is taken up in the seventh lecture, by Prof. T. H. Morgan, on the relationships of the sea-spiders. In this it is considered that the Pycnogonida, as the group to which these curious creatures belong has been termed, come nearest to the Arachnida, both as regards many peculiarities of the adult and also of the various stages of development. After discussing the morphology of the peculiar "Pantopod" larva of these forms, and its relations to the "Trochophore" of the Annelids, and the "Nauplius" of the Crustaceans, the lecturer has some observations upon the initial differences in the development of various groups of animals which are of sufficient general interest to be quoted at length. He observes :—

> "If we remember that during the time in which the groups of Annelids and Crustacea have been evolved, the larval forms themselves have been acted upon in an increased degree, there seems every reason to believe that the young may have been much more acted upon and suffered far greater changes. On the other hand, when we see in such a group as the Vertebrates that in the higher forms the young have been removed to a large extent from the action of surrounding conditions —as, for instance, by being enclosed within a shell as in the Sauropsida, or retained within the uterus in Mammals —then can we understand why the young resemble each other more closely than do the adults, for the obvious reason that the adults have had to adapt themselves to more numerous external conditions, while the embryo has remained fixed. Indeed, this may be pushed a step further, it seems to me, and explains why such young retain the characteristics of lower forms, while the adults have lost such structures. This may be due to the young having been removed to a greater extent than the adults from a process of active selection. Hence, in such a group, when we say that the ontogeny tends to repeat the phylogeny, we mean that the embryos have retained more of the ancestral features than have the adults. But in such groups as the ones we are discussing—Annelids, Crustacea, &c.—we ought to expect, if what I have said be true, the reverse of what we find in such a group as the higher Vertebrates; viz. that the young forms diverge far apart, and the adults come nearer together."

Our remarks on the foregoing lectures have extended to so much greater length than we had at first intended, that space allows little more than the quotation of the headings of the three remaining ones; although neither fails in attracting as much interest as their predecessors. The eighth lecture is by Prof. S. Watase on "Caryokinesis"—a term which it may be well to explain is derived from κάρυον, a walnut, and is applied to a peculiar kind of nuclear cell-division, as met with in Cephalopods and Echinoderms. In the ninth lecture Prof. Howard Ayers gives us an elaborate dissertation on "The Ear of Man, its past, present, and future." The lecturer concludes that the ear of the higher Vertebrates is derived by the invagination of part of a system of canal sense-organs, like the lateral line of fishes; and he ventures to predict certain lines of modification which he considers will probably arise in the human ear with the course of time. The volume concludes with an article by Prof. W. Libbey, of Princeton College, on "Ocean Temperatures and Currents."

We have already expressed our high opinion of the volume before us as containing valuable *résumés* by specialists on many moot biological topics; but we cannot conclude without recording the pleasure and interest to which its perusal has given rise in ourselves, or without heartily commending it to the attention of our readers.

R. L.

PHYSICAL GEOGRAPHY FOR SCIENCE STUDENTS.

Elementary Physical and Astronomical Geography. Specially designed for Pupil-Teachers, Students in Training, and Science Students. By R. A. Gregory. With Original Illustrations. (London: Joseph Hughes and Co., 1891.)

THE general conception and arrangement of this volume are very good, and the same may be said of the detailed treatment of most of the subjects discussed. There is, however, great inequality in the author's work. The portions dealing with mensuration and astronomy are for the most part excellent, though there is sometimes a want of appreciation of the difficulties felt by beginners, and a consequent deficiency in the explanations given. The geological and meteorological parts are less thoroughly treated, while the chapter devoted to plants and animals is so imperfect that it had better have been altogether omitted. In case the work goes to a second edition, it will be as well to call attention to a few of the points where some alteration or further elucidation would be advisable.

At p. 21 the fact that the earth has been circumnavigated is given as a proof that it is not flat. But this is no proof at all; for if the earth were a flat disk, with the North Pole as its centre and the equator midway between the pole and the southern circumference—as represented by "Parallax" and other flat-earth men—circumnavigation might be performed exactly as at present.

The fact that degrees of latitude are longer near the poles than near the equator, although the polar axis is shorter than the equatorial, is often a stumbling-block to learners. It is, in fact, one of the paradoxes, and some half-century ago Mr. Von Gumpach published a pamphlet, and wrote letters to Prof. Airy and to the Astronomical Society, demonstrating, as he thought, that the earth is elongated at the poles—is, in fact, a prolate spheroid, because, the degrees being measurably longer at the poles, shows, he maintained, that the radius is there longer. Mr. Gregory takes no notice of this difficulty, which is a very real one, and requires some explanation in a text-book for learners.